Journal of Early Modern History

Regulation and intellectual change at the Paris goldsmiths' guild, 1660-1740

--Manuscript Draft--

Manuscript Number:	JEMH-D-17-00003R1
Full Title:	Regulation and intellectual change at the Paris goldsmiths' guild, 1660-1740
Short Title:	Regulation and intellectual change
Article Type:	Full Length Article
Corresponding Author:	Michael Bycroft, Ph.D. University of Warwick UNITED KINGDOM
Corresponding Author's Institution:	University of Warwick
First Author:	Michael Bycroft, Ph.D.
Order of Authors:	Michael Bycroft, Ph.D.
Manuscript Region of Origin:	UNITED KINGDOM
Abstract:	Economic historians have shown that the regulations of craft guilds were a source of innovation rather than inertia in the economy of early modern Europe. Historians of science have shown that craftsmen contributed to the scientific revolution in the same time and place. But very little is known about the role of guild regulation in intellectual (as opposed to social, political and economic) change. This paper shows that regulation went hand-in-hand with intellectual change at the Paris guild of goldsmiths in the decades around 1700. In this period the wardens of the guild developed sophisticated techniques for organising and disseminating their large archive of legal documents. They also produced two treatises on precious stones that were the first treatises of this kind published by practising goldsmiths or lapidaries and that broke with the learned tradition by emphasising the hardness of gems and their division into varieties.
Keywords:	precious stones; natural history; Paris; goldsmiths; craft guilds; innovation; regulation; archives
Funding Information:	Leverhulme Trust (Early Career Research Fellowship) — Dr Michael Bycroft

ARTICLE II.

Objet de l'Art & Commerce des Maîtres & Marchands formant le Corps de l'Orfévrerie-Joyaillerie.

LEs Maîtres & Marchands formant le Corps & exerçant l'Etat d'Orfévrerie-Joyaillerie à Paris, auront pour objet de leur Art & de leur Commerce la Fabrication & le trafic des Ouvrages & Matieres d'or & d'argent ; avec l'emploi & le négoce des Diamans, des Perles & de toutes ſortes de Pierres fines & précieuſes, ſous le titre D'ORFEVRES-JOYAILLIERS.

AUTORITEZ.

Ces differentes & précieuſes productions de la Nature, ont toujours été l'objet fondamental & conſtitutif de l'Etat d'Orfévrerie. Ceux qui exercent cet Etat, ne doivent régulierement travailler que l'or & l'argent, d'où leur vient le nom d'ORFE'VRES : comme celui de JOYAILLIERS y eſt joint, à cauſe qu'ils ont ſeuls le droit d'employer les Pierres précieuſes & les Perles ſur les ouvrages d'Orfévrerie. Ainſi, le fait d'Orfévrerie a toujours renfermé celui de la Joyaillerie de Pierrerie ; & l'on peut dire que les Orfévres ſont en effet, auſſi eſſentiellement Joyailliers, qu'ils ſont neceſſairement Orfévres. Sans tranſcrire ici une infinité d'autoritez que nos Titres fourniſſent là-deſſus dans tous les tems, voyez ſeulement l'Edit du Roy Jean, du mois d'Août 1355, vous y trouverez parmi les divers Réglemens qui concernent le fait d'Orfévrerie, juſqu'à huit Articles de ſuite, qui preſcrivent dans un grand détail la maniere dont les Orfévres de Paris doivent ſe comporter dans le travail & l'emploi de la Pierrerie, pour éviter les fraudes qui pouvoient ſe gliſſer dans le Commerce de ces précieuſes Marchandiſes, qu'ils faiſoient encore ſeuls concurremment avec les Marchands Merciers. *Archives, Layette* 1. *cott.* 1 bis, Item, *Recueil imprimé des Ordonnances de l'Orfévrerie de Paris, p.* 4 *&* 5.

De l'union conſtante de ces deux objets de l'Etat des Orfévres, vient le double nom qui leur eſt donné dans les anciennes Ordonnances, auſſi-bien que dans les Reglemens modernes. Ils y ſont ſouvent appellez cumulativement, & comme d'un ſeul nom *Orfévres-Joyailliers*, ou par dévelopement *Orfévres* ET *Joyailliers*, ſans toutefois que dans cette derniere formule, la particule copulative ET déſigne deux Etats dif-

Regulation and intellectual change at the Paris goldsmiths' guild, 1660-1740

Michael Bycroft

Leverhulme Early Career Research Fellow
University of Warwick
Department of History
Coventry CV4 7AL
United Kingdom
+44 (0) 24 76 522080
M.Bycroft@warwick.ac.uk

Acknowledgements. Drafts of this paper benefited from comments from audiences at the University of Cambridge, the University of Warwick, and the Victoria and Albert Museum. Research for the paper was carried out during postdoctoral fellowships supported by the Max Planck Institute for the History of Science, the Leverhulme Foundation, and the History Department at the University of Warwick. The author is indebted to Sven Dupré, Giorgio Riello, and Maxine Berg for their advice and encouragement during this research, and to two anonymous reviewers for their insights and suggestions.

Regulation and intellectual change at the Paris goldsmiths' guild, 1660-1740

Abstract

Economic historians have shown that the regulations of craft guilds were a source of innovation rather than inertia in the economy of early modern Europe. Historians of science have shown that craftsmen contributed to the scientific revolution in the same time and place. But very little is known about the role of guild regulation in intellectual (as opposed to social, political and economic) change. This paper shows that regulation went hand-in-hand with intellectual change at the Paris guild of goldsmiths in the decades around 1700. In this period the wardens of the guild developed sophisticated techniques for organising and disseminating their large archive of legal documents. They also produced two treatises on precious stones that were the first treatises of this kind published by practising goldsmiths or lapidaries and that broke with the learned tradition by emphasising the hardness of gems and their division into varieties.

Keywords: precious stones; natural history; Paris; goldsmiths; craft guilds; innovation; regulation; archives

Parisian goldsmiths were synonymous with fine jewellery in seventeenth-century Europe, but some of their most remarkable works were made of ink and paper rather than gold and silver. One of these works was *Mercure Indien, ou, Le tresor des Indes*, first published in 1667; another was *Traité sommaire de l'institution du corps et communauté des marchands orfèvres,* first published in 1672. The former was a landmark in the history of gemology: it was the second printed book on the natural history of gems to be published by a goldsmith or gem-cutter; the first such book, *Merveilles des Indes*, had appeared six years earlier and had been written by another member of the Paris guild of goldsmiths, Robert de Berquen. The *Traité sommaire* was a milestone in the regulatory history of the guild: it was the first in a long series of publications in which the goldsmiths sought to collate, codify and disseminate their large archive of legal documents. *Mercure Indien* and *Traité sommaire* are notable in their own right, but what makes them remarkable is the connection between them. Most obviously, they were written by the same person, Pierre de Rosnel, and they were published together in one volume in 1672. But the affinities run deeper than that. The form, content and timing of *Mercure Indien* were bound up with the regulatory concerns described in the *Traité sommaire*, especially the quality of materials, the codification of texts, and the attempt by Parisian gem-cutters to encroach on some of the goldsmith's privileges.

This paper shows that regulation went hand-in-hand with intellectual change in an early modern craft guild. In doing so it answers Karel Davids' call for "bridging concepts", concepts that connect economic history with the history of science and technology.[1] "Guild regulation" is a promising concept of this kind, not least because craft guilds "provided European urban manufacture with its main institutional framework for over six hundred years."[2] If guilds were the mainstay of the urban economy, regulations were the mainstay of the guild. "Regulation" here means rules that were written down, that were endorsed by local rulers and law courts, and that governed such things as who entered the guild, how guild members were trained, and

which products the members of the guild were permitted to buy, sell, or make. These regulations covered many details of the life of guild members, from the words they included on their shop-signs to the number of instruments they held in their workshops to the amount of money the guild would supply to their widows upon their deaths. As one goldsmith put it, the rules of the guild "governed the smallest points of discipline in astonishing detail."[3]

Guild regulations have been studied in greatest detail by economic historians, principally to measure their effects on the wider economy.[4] Critics of the guilds see these regulations as a means of enriching guild members and excluding competitors; in the words of one critic, they enabled "rich and powerful men to grab a bigger slice of the pie."[5] This view prevailed among historians and economists from the middle of the eighteenth century to the end of the twentieth. Since the 1980s the overall trend in economic history has been to emphasize the benefits rather than the costs of guild regulations.[6] To take one well-documented example, the rules surrounding apprenticeships have been reinterpreted as a device for encouraging masters and students to invest in the training of a new generation, an investment that would otherwise be too risky for both parties.[7] To be sure, both sides in this debate point out the dangers of taking written regulations at face value. The difficulty of enforcing these rules is a common argument against the traditional view that they were a dead weight on the early modern economy; so is the fact that guilds usually did not have a free hand in writing their rules, constrained as they were by the vagaries of markets and migration and by the powers of cities and states, whose interests often did not coincide with those of the guilds.[8] But even the revisionists assume that many guild regulations shaped the behavior of various economic actors. To pursue our example, the revised view on apprenticeships assumes the efficacy of a range of rules, from those specifying the fees paid by apprentices to masters, to those ensuring that apprenticeships would not be cut short by the death of the master.[9] Guild regulations may have been good or bad; either way, they mattered.[10]

While economic historians have explored the economic dynamism of early modern artisans, historians of science have explored their intellectual dynamism. The result has been the revival of the thesis that the crafts played an important role in the dramatic changes in natural knowledge that occurred in early modern Europe.[11] This thesis dates back to at least the sixteenth century, when many writers argued that "natural philosophy" had much to learn from the "mechanical arts", to use the contemporary terms for, on the one hand, the mental investigation of the causes of nature's effects, and on the other, the manual creation of materials and machines.[12] The contribution of potters, gunners, and miners to the science of Galileo, Boyle and Newton was downplayed by most historians of science in the middle decades of the twentieth century. Since the 1970s scholars have played up this contribution, and in doing so they have expanded on the classic statement (by Edgar Zilsel, in the 1930s and 40s) of the thesis that artisans influenced the scientific revolution. They have shown, for example, that this influence applied just as well to mathematical sciences such as optics as it did to experimental ones such as chemistry; that scientific theories made a practical difference to some crafts well before the rise of the electrical and chemical industries in the nineteenth century; and that interactions between scholars and artisans took place, not just in books, but also in physical locations such as mines, arsenals, workshops and libraries.

The literature surveyed in the last two paragraphs is strangely silent about the role of guild regulation in intellectual change. Economic historians who write on regulation are very often concerned with creativity and innovation, but by this they mean innovation in technology and (occasionally) creativity in painting and sculpture. They do not mean intellectual novelty.[13] Conversely, historians of science who write on artisans are very often concerned with guildsmen, but they rarely dwell on the role of guild regulation in the intellectual output of those artisans. They do dwell on regulations imposed by state bodies, such as the Customs and Excise Board in England or the Bureau de Commerce in France.[14] They also dwell on the role

of cities and royal courts in bringing together artisans and scholars.[15] They sometimes use guild regulations as indicators of larger changes, such as the emergence of the notion of authorship in the crafts in the thirteenth century or the rising status of "fine" arts such as painting and sculpture in the seventeenth.[16] But the idea that guild regulations shaped the intellectual life of artisans in a deep and innovative way is almost entirely alien to historians of early modern science. If there is a standard view on the matter, it is the one that Edgar Zilsel sketched out in 1941: "since the decay of the guilds and their traditionalism, real observation of natural phenomena, and even some experimentation, were to be found among skilled manual workers."[17] In other words, artisans became scientific in spite of the guilds, not because of them.

Guild regulation is a corrective to this view, especially if we view regulation as an archival enterprise—that is, if we focus on the techniques that guildsmen used to preserve, organize and disseminate the collections of texts that were the physical embodiment as well as the legal basis of their regulations. The archives of artisans is another rich topic that tends to fall between disciplinary stools. The economic historians discussed so far have shown the abundance and efficacy of guild regulations, but they treat the latter as guides to the practical activities of guildsmen rather than as a set of literary activities that are worthy of study in their own right. Historians of science and technology have studied a range of texts produced by early modern artisans, including inscriptions on paintings, recipe collections, books of secrets, learned treatises, practical handbooks, encyclopedia articles, and tables of prices and other technical data.[18] But regulatory texts rarely appear in this literature, perhaps because they tell us relatively little about materials, machines, and manual skills. Historians of life-writing have made innovative use of artisanal texts such as chronicles and account books, but there is little room for regulation here either, since regulations tell us much more about institutions than they do about individual artisans.[19] Finally, historians of the archive have changed our view of

several early modern institutions—especially states, religious communities, and scientific societies—by paying close attention to the way these institutions managed textual information.[20] But the archival turn has yet to reach the craft guilds, to judge from the contents of the journal *Archival Science* and of several recent edited collections that touch on archives in early modern Europe.[21] This is a missed opportunity. As I hope to show in the following, the archive of the goldsmiths' guild was bound up with the regulatory and scientific life of the institution. I deal in turn with these three aspects of the guild's activities—archives, regulation, and science, the latter in the form of natural history—before tying the three together in the conclusion.

1. Archives

The goldsmiths of Paris took the archival turn between 1672 and 1741. They had maintained an archive of sorts since at least the thirteenth century, and had held printed copies of their statutes since the end of the fifteenth century, but it was only in the decades around 1700 that they printed summaries of the archive and drew up comprehensive inventories of its contents.[22] Rosnel's *Traité sommaire* of 1672 was the first of the printed summaries. Rosnel intended this treatise for the general public, and especially for "those who are unfamiliar with the privileges and advantages of the merchant goldsmiths, the glory and honour of their art, and the great and inviolable exactitude of their conduct." More to the point, Rosnel's aim was to "shut the mouths" of those who would "contest" the guild's privileges.[23] Rosnel expanded upon these claims in the first half of the treatise, and in the second half he backed them up with extracts from the guild's archive. These extracts appear in a distinct block of text with its own title ("Recueil des statuts, ordonnances, reglemens, & privileges…") and its own pagination.

Rosnel refers to the archive in the title of the "Receuil" and in an endnote. Here we learn that "the originals are conserved at the Bureau de l'Orfévrerie de Paris", where they were held "among a good number of other [documents] in the *Thresor des Chartres du Bureau*", of which more anon. Rosnel recommended his printed extracts on three grounds: they were selective, containing only "the most considerable" documents, and only "those that are most commonly used"; they were a substitute for the originals, a boon for "those who would have trouble obtaining the documents and the information therein"; and they were easy to search, thanks to "the easy and useful order in which everything is here reduced and digested." The latter point was not an idle boast: the extracts are organised into topics, each with a clear title; and within each topic they are sorted by date, with the date of each extract serving as its heading. The titles served not only to organize the material but also to name those whose "mouths" Rosnel wished to "shut": "Against shop-keepers", "Against lapidaries", "Against clockmakers", "Against engravers", run the headings in one section. Rosnel's barb was sharpened by two other properties of his extracts that he did not fail to point out to the reader. Firstly, the extracts in the second half of the treatise served as "proofs and justification" of the assertions in the first half. Secondly, the extracts were derived directly from legally binding documents, since they had been "transcribed" from "original" documents that were "conserved" by the guild. These were Rosnel's solutions to what we might call the paradox of the public archive, ie. the problem of diffusing an archive without diluting its authority.[24]

But documents in the archive could not be diffused if they could not be found. Rosnel tells us nothing about the location in the archive of the originals he had extracted, and he tells us very little about the contents of the many originals he did not extract. A satisfactory solution to these problems did not come until 1741, when the goldsmith Pierre Le Roy completed the second and last volume of his *Inventaire general*.[25] This is an inventory of the goldsmith's archive that runs to over 900 pages and that collates nearly 2,000 documents. One of its best

features—at least from the point of view of a historian of the archive—is a preface that describes how the inventory came about and why it is superior to its predecessor. Here we learn that, "for time immemorial", the goldsmiths had kept the documents in their "*archive*" or "*depost*"; and that these documents, "which are very dear to us", were stored in an annex to their chapel known as "*le Tresor*", so named because the guild's silver was stored in the same room. Experience had revealed two problems with this arrangement. Firstly, the short walk from the guildhall to the chapel proved too much for some wardens, who simply stopped consulting the documents—much to the detriment of the guild's affairs, "in the pursuit of which we must always be guided [by the archive]." Secondly, the regular use of the silver for services in the chapel meant that the treasury was frequented by "people who do not always share our interest in avoiding the dissipation of documents." [26]

The obvious solution was to relocate the archive to the guildhall, and for this purpose a set of cabinets (*armoires*) was installed in a room that Le Roy refers to as "*la Chambre des Archives*." It remained to carry the documents from the annex and place them in the appropriate order in the cabinets. But the attempt to do so soon revealed the true state of the archive:

> Everything was found pell-mell in an extreme confusion, due to our long failure to put things back in the right place. The result is that, of the prodigious number of pieces of all kinds that we have successively accumulated over the course of nearly five hundred years, there were barely any two on the same subject that were placed together. The first thing to do was to bring some order to this chaos…[27]

Bringing order to the chaos meant, firstly, getting rid of duplicates and other useless documents, and secondly, organizing the remaining documents by topic. The wardens hoped

to make short work of the second task by using the topics outlined in an inventory compiled by one of their predecessors in 1706.[28] But this proved much too optimistic. The inventory in question showed no signs of ever having been used, for several good reasons that Le Roy enumerated: it traced the origin of the guild to the year 1330, making the guild seventy years younger than it really was; it omitted key documents and contained long-winded descriptions of trivial ones; it erred in its descriptions of many documents; errors in the dates meant that some documents were treated as fundamental when they merely repeated earlier documents; and its division of the archive into topics was too course to be much use as a search tool. In short, "there was an urgent need for another inventory, one more accurate, orderly, and comprehensive."[29]

The new inventory was an impressive piece of work, as was the new archive that went with it. The wardens began by filling the gaps in the archive by making copies of the originals; they insured themselves against future losses by noting the location of the originals, whether these occurred in public archives or in published texts. For the sake of accuracy, when they used extracts from earlier compilations, such as Rosnel's, they checked the text of these extracts against the corresponding document in the archive. Most importantly, they devised a new classification scheme made up of no less than 75 topics, each with a descriptive title and an alphabetical code running from "A" to "FFF." As a result, anyone interested in the "examination, masterpiece and reception of aspiring masters", or "the police of the shopkeeper's guild between 1587 and 1673", or "offices created by the guild before being merged or suppressed", would know exactly where to look. They would know where to look for the extract, since the inventory of extracts came with a table of contents that gave the title, label, and page number of each topic. They would also know where to look for the full text, since the cabinets in the archive room were filled with seventy-five iron boxes (*layettes*) that were each labelled with the code of one of the topics. These drawers were the core of the

archive; they took up five cabinets in the archive room. At least six other cabinets were needed to store a range of lesser pieces: originals of documents not extracted in the inventory, stored in seventy-five cardboard boxes; printed duplicates of items extracted in the inventory, stored in seventy-two packets; and some 200 registers, these stored on top of the cabinets such that their spines marched around the upper perimeter of the room.[30]

The wardens left little to chance in the usage and upkeep of the archive. They inserted a chronological table of documents at the end of the inventory, for those who preferred to browse by date rather than topic, or who wished to review "the abridged history of the community."[31] They numbered the documents in each box from 1 onwards, so that each document had a unique reference made up of this number and the alphabetical code of the box in which it occurred. They gave page references to a 1688 *Receuil* which had contained the full text of many documents; these references were for users who preferred to read the book rather than rummaging through the iron drawers in search of the original. They drew up a list of missing documents to stimulate the search for documents that were not yet available in full in the archive. They drew up another register to record the removal of documents from the archive and to ensure their safe return. And because even regulations need to be regulated, Le Roy ended his preface with a list of regulations for the sustainable use of the archive room: visitors who are not members of the guild must be accompanied by at least one warden; a note must be made of all items that are removed from the room for whatever reason; items removed from the room must be returned as soon as possible to the correct box, and their return noted on the register; and at the end of each year newly arrived items must be placed in the appropriate boxes and extracted in the inventory. If these rules were not observed, le Roy warned, "we will see our archive fall imperceptibly into the confusion from which we have rescued it."

Even if the rules were observed, however, the inventory was little use on its own. The challenge for wardens was not just to find the documents they wanted but to reconcile the contents of the documents they found. The problem, Le Roy explained, was "the frequent contradictions between one document and another due to changes in their stipulations that have occurred over time." The archival work of wardens was made "very unpleasant" by the need to "untangle the authorities that must be employed to defend or maintain their rights or the internal regulation of the community." Rosnel had dodged this problem in his *Traité sommaire* by supplying extracts of a tiny fraction of the documents in the archive. Le Roy's inventory revealed the full extent of the problem by giving the wardens rapid access to the entire archive. The *Recueil* of 1688 achieved the worst of both worlds by compiling a large number of documents in one volume without providing a usable summary or index.

Le Roy supplied his own solution in his *Statuts et reglements*, a 300-page book printed in Paris in 1734. This work was a triumph of classification, scholarship, legal judgement, cataloguing and type-setting. Le Roy distilled the regulations of the guild into 145 articles; next, wishing to "distribute these articles in a more methodical order", he grouped them into sixteen chapters. His scholarship consisted in scouring the archive for documents relating to each article, identifying discrepancies between these documents, and resolving these discrepancies in favour of (all else being equal) the most recent documents. At the same time he drafted short accounts of the "origin, motives and spirit" of each article, paying close attention to the evolution of the regulations over time and to the contemporary meanings of terms used in past documents. Like Rosnel he was anxious to show that his summaries of original documents were indeed based on those documents; unlike Rosnel, he could refer precisely to documents in the goldsmith's archive. For example, after summarizing the statutes accorded to the goldsmiths in 1260, he refers the reader to "les Archives de la Maison commune des Orfévres de Paris, Layette 1, cotte 1." In other words: "see the first document

in the first box in the archives." The details of Le Roy's research might have bewildered the reader of his *Statuts et reglements* if not for the cunning layout of the text on his pages, especially the use of footnotes and a variety of font sizes and styles. These devices meant that the reader could move from the general to the particular, and from an article to the legal basis for the article, simply by running her eye down the page (see figure 1).[32] *Statuts et reglements* was a masterpiece of compression, a great improvement on Rosnel's *Traité sommaire*. Both works show that goldsmiths—or at least wardens such as Rosnel and Le Roy—worked as much with paper as they did with gold and silver.

[Insert Figure 1 about here, with the following caption: A page from Pierre Le Roy, *Statuts et reglements* (Paris, 1734). Note, from the top the page to the bottom: the chapter in which this page occurs ("Du Corps en general…"); the number of the article ("II"); a heading for the article ("Objet de l'Art & Commerce…"); a summary of the article ("Les Maîtres & Marchands…"); and a chronological summary of "authorities" that support the text of the article, with references to documents in the guild's archive (eg. "Archives, Layette 1, cott. 1 bis").]

2. Regulation

Much of this paperwork was generated by the guild's efforts to manage other guilds and to evaluate materials. The former theme may be illustrated by the long-running conflict between the goldsmith's guild and the lapidary's guild. This conflict can be traced to the bifurcation of the two communities at the end of the sixteenth century. A small number of gem-cutters had existed in Paris before this time, some within the goldsmith's guild and some without, but

their numbers were swelled in the 1570s and 1580s by the arrival by expert cutters from Antwerp after the Spanish assault on the city in 1576. The mixed community of cutters in Paris received its first statutes in 1584: there they are referred to as the "corps des maitres lapidaires, tailleurs, graveurs, ouvrans en toutes sortes de pierres precieuses," a name usually abbreviated to "corps des lapidaires" in legal documents of the period.[33] This guild was created in the face of bitter opposition from the wardens of the goldsmith's guild. The latter were jealous of their right to cut gems, a right that they had exercised since at least the fourteenth century[34] and which they claimed to have possessed since time immemorial (*de tout temps et ancienneté*)[35]. The goldsmiths probably also feared for their right to sell unmounted gems, a right that the Paris shop-keeper's guild (*marchands-merciers*) had challenged earlier in the century.[36]

These fears were confirmed by the statutes of 1584 and by the ensuing litigation.[37] One clause of the statutes granted lapidaries the exclusive right to cut, pierce and engrave precious stones; another gave them the exclusive right to purchase precious stones from foreign merchants who visited Paris. The goldsmiths mounted a legal challenge to both of these clauses, but resistance from the lapidaries meant that the dispute was not resolved until 1631. A ruling of that year meant that the two guilds had equal rights to buy and sell unmounted stones and unequal rights to work them—only lapidaries were permitted to cut gems, and only goldsmiths were permitted to mount them. The dispute flared up again in the 1660s, when lapidaries were convicted of mounting precious stones and of working with sub-standard gold and silver. These convictions were followed in 1670 by a judgement (*arrêt*) by the Coinage Court that confirmed the goldsmiths' right to inspect gold and silver worked by lapidaries. Three years later the 1631 prohibition on gem-mounting by lapidaries was confirmed by royal decree.[38] Even this did not put an end to the squabbling between the two guilds, which continued until the lapidary's guild was swallowed up 1781 by its older, richer,

and more powerful parent. The conflict generated enough litigation to fill three boxes in the goldsmith's archive by the time Le Roy compiled his inventory in the 1730s.[39]

The stakes of this dispute were raised by the expansion of the gem trade in Paris in the seventeenth century. As the pie grew, so did the competition for a slice of it. Systematic data on the French gem trade in this period are hard to obtain, partly because the lapidary's guild has not left a substantial archive of its own[40] and partly because the Paris trade was not substantial enough to attract economic historians, who have focused instead on the contemporaneous trade in Lisbon, Venice, Antwerp, Amsterdam and London.[41] Yet there is much qualitative evidence that the seventeenth century, including the 1660s and 1670s, was a bumper period for buyers and sellers of gems in Paris. There was an abundance of skilled cutters in Paris between the arrival of Dutch artisans after 1576 and the departure of Protestant artisans after the Revocation of the Edict of Nantes in 1685. These cutters introduced double mills into the capital[42], spawned a second lapidary's guild there[43], invented the brilliant cut[44], and caught the attention of André Félibien, an architect and historian who described the art of faceting in a 1676 treatise, remarking that this process was "easy to see every day among lapidaries and jewellers" in Paris.[45] Royal demand rose at the end of the wars of religion and remained high for the following century: courtiers of Henry IV attending an event in 1595 were "so burdened with stones and gems that they could scarcely move" [46]; Louis XIV began his reign as he meant to go on, sporting diamonds on his boots, helmet and belt-buckle at a horse tournament in 1662.[47] Successive kings employed merchants and travellers—often of Flemish or Portuguese origin, but also Frenchmen such as Jean-Baptiste Tavernier—to win their share of mineral wealth arriving in Europe from Asia and the Americas.[48]

The goldsmiths met these changes with a mixture of opportunism and conservatism. They partook in the profitable new trade, embedding gems in their masterpieces [49], displaying

gem-studded jewels in the shops[50], travelling abroad to sell these items[51], and seeking contracts from jewellers attached to the royal household and from goldsmiths and gem-cutters working at the newly-established royal workshops at the Louvre and Tuileries.[52] But they were wary of merchants and artisans who practised their trade and who lay outside their jurisdiction. These included individuals who belonged to a different guild (like the lapidaries), those who worked under the king's protection (goldsmiths at the Louvre and Tuileries), or those who worked inside the walls of a privileged religious community (the small lapidary's guild in the Faubourg Saint-Antoine).[53]

Quality control was a recurring theme of the warden's attempts to curb these groups and to reign in wayward journeyman and apprentices in their own guild. They harassed lapidaries who worked with counterfeit gems or insufficiently pure metals. Conversely, the lapidaries' main argument for stripping the goldsmiths of their right to cut gems was that the cutting and mounting of gems should be practised by different artisans in order to deter counterfeiters.[54] The goldsmiths later made the opposite argument: frauds were so convincing that only an artisan trained in both cutting and mounting could detect them.[55] In his 1734 treatise, Pierre Le Roy described the elaborate system of measures, marks and inspections that was designed to maintain the quality of gold- and silver-ware traded in Paris.[56] The economic importance of gold and silver meant that penalties for violating these rules could be severe: in 1667 a journeyman goldsmith received a death sentence for placing a false mark on a work intended for Louis XIV.[57] Le Roy also described the guild's measures against counterfeit gems, a category that included real stones that were altered to resemble superior stones (*pierres déguisées*) as well as objects that were not stones at all but that were passed off as precious stones (*pierres fausses*). Since at least the fourteenth century, goldsmiths had been forbidden from mixing real and fake stones in the same work, and from disguising stones by dying them, cutting them or mounting them on coloured leaves.[58] By 1734 these rules had been relaxed

somewhat, but in the seventeenth century they were still being enforced against lapidaries and shopkeepers in Paris, as the documents in Le Roy's inventory attest.[59]

Robert de Berquen and Pierre de Rosnel were familiar with these regulatory concerns because they were consummate guildsmen. They each had several family members—grandfathers, fathers, brothers, sons, nephews—who were members of the guild.[60] Both followed the usual route for entry into the guild: an apprenticeship, a period as a journeyman, and promotion to the status of master after the completion of a masterpiece. Both became masters in their early 20s, Berquen in 1623 and Rosnel in 1639; both were veterans of the goldsmiths' art when they published their lapidaries in, respectively, 1661 and 1667.[61] Both men also played important roles in the day-to-day administration of the guild. Berquen served as the guild's clerk from 1651 to his death in 1673; his duties included signing the guilds' legal documents and disposing of gold- and silverware confiscated by the wardens. Rosnel moved further and faster up the guild hierarchy than Berquen. In the decade in which *Mercure Indien* appeared, he served as a warden's assistant (*ayde de garde*, 1661), warden (*garde*, 1662 and 1670), and senior foreman (*grand-garde*, 1671).[62] In the first of these positions Rosnel had the invidious task of inspecting the workshops of artisans in Paris who worked with precious gems and metals, including other members of the goldsmiths' guild. The position of warden was more prestigious but more onerous, since it meant supervising not only the inspections but also the assaying of gold- and silver-ware produced by guild members, a massive task since *every* piece of such ware needed to be assayed under the eyes of the wardens at the guild hall. The position of senior warden simply meant that Rosnel was a warden for two years running, an indication of his seniority and perhaps also of his high standing in the guild.[63]

The regulatory environment of the guild affected the two men in different ways. Berquen entered the guild eight years before the judgement of 1631 that deprived goldsmiths of the right to cut and polish gems. This helps to explain why, as *Merveilles de Indes* attests,

he had an extensive knowledge of these processes. In his preface to the treatise Berquen wrote that he "knew better how to cut a diamond, or how to mount one, than to cut a feather and write a single correct line."[64] Berquen also gave a detailed account of the instruments and procedures involved in faceting diamonds. Berquen's claim that this process was invented by Louis de Berquen in 1476 is false, but his description of the process is accurate. He described how lapidaries cement two diamonds in place and grind them (*egriser*) against each-other to produce a powder, which they then use to cut and polish the diamonds on an iron wheel (*rouë*). This description, including the terms *egriser* and *rouë*, is consistent with Félibien's description of the same process.[65] Berquen's treatise also shows that he was familiar with different kinds of cut and with their suitability for different kinds of gem. For example, he noted that sapphire, topaz, and amethyst should be cut in the form of a square with eight faces, since this gave them a satiny appearance, whereas other kinds of cut gave them velvety appearance. The same applied to chrysolite and iris, except when those stones had blemishes. Berquen remarked that lapidaries used to facet these stones irrespective of their quality, until they discovered that a single blemish will appear doubled in a stone with two facets, tripled in a stone with three facets, and so on.[66]

Unlike Berquen, Rosnel became a master goldsmith at a time (1639) when lapidaries had a monopoly on the cutting and polishing of gems in Paris. Accordingly, *Mercure Indien* contains much less information on these processes than *Merveilles des Indes*. Whereas Berquen studied gems with the hand of the artisan, Rosnel studied them with the eye of the merchant. The most obvious manifestation of Rosnel's interest in commerce is the 23-page treatise on the evaluation (*éstimation*) of the price of gems that he attached to the end of *Mercure Indien*.[67] This treatise is remarkable not only for the large number of gems it covers but also for the author's nuanced understanding of the factors that determine the price of any given gem.[68] Rosnel noted, for example, that a group of pearls of uniform shape and size was worth

considerably more than a variegated group with the same total weight; and that large gems were disproportionately expensive, so that (for example) rubies weighing more than 5 carats were worth as much per carat as diamonds. Rosnel's interest in the "*estimation*" of gems was not confined to the manual at the end of his lapidary. It was also apparent in the lapidary itself, where he peppered his descriptions of individual gems with remarks on their value or "*estime*." Rosnel tells us, for example, that white amethysts are scarce in Europe because they are highly prized in India; that the price of emeralds has plummeted since the Spanish began importing them from South America; and that hyacinth has fallen from favour since ancient times.[69]

The conflict between the goldsmiths and lapidaries may have played another role in Rosnel's treatise, namely that of motivating its publication. *Mercure Indien* was published in 1667, not long after two lapidaries were convicted (in 1665 and 1666) of encroaching on the rights of goldsmiths. The second edition appeared in 1672, in the midst of a legal dispute between the goldsmiths, the lapidaries, the Coinage Court and the Conseil d'Etat about the legitimacy of the 1631 judgement that had deprived goldsmiths of the right to cut gems. Rosnel's administrative duties at the guild meant that he was personally involved in these disputes. He was warden in 1670 and 1671, meaning that he was probably one of the authors of a petition that the goldsmiths sent to the Coinage Court in August 1671 as part of what was then known as the "*affaire des lapidaries*." The following year he summarised several documents relating to the affair in the *Traité sommaire*, under the heading "Against the lapidaries."[70] Probably he had the lapidaries in mind when he defined goldsmiths "those who were the first to mount precious stones in gold and silver", and when he described the aim of the treatise as "showing the importance that gold and silver, and especially precious stones, do not fall into the wrong hands."[71] It is not surprising that Rosnel appended the *Traité sommaire* to the second edition of the *Mercure Indien*: both texts implied that goldsmiths had special authority in the domain of precious stones.

The publications of these two men also reflected their role in quality control at the guild. *Les merveilles des Indes* and *Mercure Indien* were both two-part works, the first on gold and silver and the second on precious stones. Both authors gave lists of the purity of gold and silver in various European polities in the hope of demonstrating that Parisian metals were the purest of all. Rosnel in particular went into considerable detail about the assaying procedures that enabled a Parisian goldsmith to know or "*connaistre*" the purity of a piece of gold or silver.[72] As a warden, Rosnel was responsible for teaching this standard to aspiring masters, for checking it when he assayed the works of existing masters, and for enforcing it when he made his rounds as an inspector.[73] Both men returned to the topic in their later works, Rosnel in his *Traité sommaire* and Berquen in his *Le livre d'allois en or et en argent*, a sort of study guide on the arithmetic of alloys, a work designed for journeymen preparing for the oral examination that preceded the submission of their masterpiece.[74] There is similar tract at the end of *Les merveilles des Indes* entitled "Advice for apprentice goldsmiths": here Berquen summarised what an aspiring master needed to know about the identification of gems and about the mounting of gems in gold and silver.[75] These two pedagogical writings suggest that Berquen had a particular interest in the training of apprentices, perhaps as part of his duties as clerk, and that assessing the quality of gems, gold and silver was central to this training. These assessments were not incidental to Berquen's and Rosnel's natural histories of gems. The quality of gems was central to their classification of gems, as was the price of gems (for Rosnel), the cutting of gems (for Berquen), and the reduction of a large amount of text into an "easy and useful order."

3. Natural history

> LAPIDARY [*LAPIDAIRE*]. n. m. Worker who cuts precious stones. Merchant who trades them, or one who is an expert in recognizing [*connoistre*] them. Travelers say that the Great Moghul of today is an excellent *Lapidary*. *Lapidary* also refers to authors who have written on precious stones, such as Rosnel, Berquen, Boodt, &c.[76]

The *Dictionnaire de Trévoux* was not the only eighteenth-century authority that gave a special place to Berquen and Rosnel in the history of writings on precious stones. Scientists at the Paris Academy of Science were also familiar with *Merveilles des Indes* and *Mercure Indien*, both of which had gone through two editions in the seventeenth century.[77] When Charles Dufay reviewed past writings on the luminosity of diamonds, as part of a series of groundbreaking papers on static electricity, he cited four works from the seventeenth century, among them the lapidaires of Rosnel and Berquen.[78] Berquen and Rosnel were also cited favourably by René Réaumur and René-Just Hauy, respectively the leading naturalist at the Academy at the start of the eighteenth century and the leading crystallographer at the end of it—though Réaumur noted that Rosnel's treatise was hard to find in Paris in the 1710s.[79] These two treatises also caught the eye of Antoine-Joseph Dezallier d'Argenville, the lawyer and writer who summarized 51 treatises on mineralogy in his widely read *Oryctologie* of 1755, and who included Rosnel and Berquen on a list of four individuals who had written on precious stones "as jewelers."[80]

What Argenville failed to point out is that Rosnel and Berquen did not write the same kind of book as the other two jewelers he mentioned, the sixteenth-century Italian Benvenuto Cellini and the seventeenth-century Frenchman Jean-Baptiste Tavernier. Rosnel and Berquen may have written as jewelers, but their books had the form of natural histories. That is to say, they were divided into two parts, the first dedicated to the causes of gems and the second (and

much longer) part to describing each gem in turn and grouping gems of like nature. Berquen and Rosnel were probably the *first* Western jewelers to publish natural histories of precious stones, to judge from modern bibliographies of gemology and mineralogy.[81] Neither man tried to hide the fact that he was an artisan entering a learned tradition, one that ran from Pliny the Elder's *Naturalis Historia* (c. 77 CE) to Boethius de Boodt's *Gemmarum et lapidum historia* (1609) via Albert the Great's *Liber mineralium* (c. 1250). On the contrary: the title-page of *Merveilles des Indes* contains no less than three references to the guild, the most telling being in the sub-title of the work, where we learn that this "new treatise on precious stones" will place each stone "according to its order and degree, in accordance with the knowledge [*cognoissance*] of Merchant Goldsmiths."[82] Rosnel asserted that goldsmiths had a better "*connoissance*" of precious stones than "*Naturalistes*", who unlike goldsmiths did not handle gems on a daily basis.[83]

The goldsmith's everyday experience of gems caused them to depart from their learned predecessors in two crucial respects. Berquen's innovation was to make the *hardness* of gems, as opposed to their colour, a major criterion for classifying them. The aim of the treatise, he wrote, was to "order precious stones according to their degree of perfection, and principally to that of their hardness, from which derives all their visible lustre and beauty."[84] This was not just a rhetorical flourish. Hardness made a difference to the order in which Berquen ranked gems, the groups into which he placed them, and the way he divided them into varieties. It meant, for example, that he placed topaz above ruby in the hierarchy of gems, and opal well below sapphire.[85] By contrast, Boodt had placed topaz well below ruby, and opal on the same level as sapphire. Berquen's rule also meant that he grouped topaz and sapphire in one chapter, and amethyst and aquamarine in another. As he said of topaz and sapphire, "these two stones do not differ in nature or in hardness, but only in colour."[86] By contrast, Boodt had grouped

topaz with chrysoprase because they were both greenish-yellow, and amethyst with ruby because they were both reddish.

Berquen's divisions of gems into varieties are especially interesting because he explicitly rejected some of Boodt's varieties in favour of his own. Hyacinth is a striking example. Boodt had divided this stone into four varieties based primarily on their colour. The first kind was scarlet-coloured and gave off a fire-like light; the second had the reddish-yellow colour of saffron; the third resembled amber in its colour but not in its hardness; and the fourth were the colour of white rubies. In this division, Boodt only referred to hardness once, and then to distinguish a variety of hyacinth from amber, not to distinguish between two varieties of hyacinth. Berquen, in *his* chapter on hyacinth, summarised this division and named Boodt as his source, before proceeding to his own division. The Oriental hyacinth was as hard as Oriental amethyst and had a vivid orange colour; the Portuguese hyacinth was somewhat softer than the Oriental one, and had a slightly different colour; and the third variety came from Bohemia (Berquen said nothing about its colour or hardness). In sum, Boodt did not use hardness to distinguish any of his four hyacinth varieties from eachother, whereas Berquen used it to distinguish two of his three varieties. Moreover, Berquen mentioned the hardness of these varieties before he mentioned their colour, suggesting that the former was the more important criterion in his eyes. In his description of opal, too, Berquen modified Boodt's sub-division of the stone to shift the emphasis from colour to hardness.

The likely cause of Berquen's emphasis on hardness was his knowledge of the process of cutting and polishing gems. These activities were (and are) impossible to carry out successfully without some sense of the relative hardness of different stones. This is abundantly clear in André Félibien's description of the lapidary arts as practised in Paris in the time of Louis XIV. Félibien explained that different kinds of stone required different tools, depending on their hardness. Diamond was the hardest stone of all and therefore must be cut and polished

on an iron wheel covered with a layer of diamond powder. Ruby, sapphire and topaz were cut and polished with a different set of tools; balais rubies, spinels, emeralds, jacynths, amethysts, garnets, agates were cut with a different set again; and so on.[87] Insofar as lapidaries classified gems, they did so according to their hardness. And the classification that resulted had more in common with Berquen's than it did with Boodt's. It separated stones of the same colour (ruby and amethyst) and combined stones of different colours (ruby and sapphire), and as a result it promoted topaz and denigrated opal. Berquen himself noted the connection between the manipulation and classification of stones. He wrote that he had sub-divided hyacinth "in accordance with my Art, and with the experience I have acquired." Elsewhere, discussing the knowledge of how to distinguish one gem from another, he claimed that "this knowledge is reserved to Masters of the Art, by which I mean goldsmiths, who are concerned with nothing else, and handle nothing else, all their lives."[88]

Rosnel also connected goldsmithing to classification, but he did so through the commerce of gems rather than the manipulation of them.[89] Rosnel's interest in the commerce of gems explains why he emphasised certain features of the gems he discussed (price and geographical origin) and why he downplayed another feature (hardness). But this was not his most striking departure from Boodt and Berquen. Rosnel also placed a new emphasis on *the very idea of a variety*. This point emerges most clearly in his chapter on amethyst.[90] This chapter is five paragraphs long, and each paragraph is dedicated to a different variety of amethyst. None of the paragraphs describe amethyst in general. Most of the text is dedicated to distinguishing between these varieties, and between them and the varieties of other species. There is no discussion of the origin of the term "amethyst," the medical virtues of the stone, or famous historical specimens, topics that featured in most of Berquen's descriptions of stones. There is some text that is not strictly about varieties, but this text is short, and it is subordinate to the discussion of varieties: in the paragraph on Oriental amethyst, Rosnel lists the Hebrew

and Indian names for that variety of amethyst; in order to introduce Carthaginian amethyst, he lists some localities mentioned by Pliny. Fittingly, the title of the chapter is a list of the main varieties of amethyst: "De l'amethiste Orientale, de l'amethiste de Carthagene, & des communes."

By contrast, Berquen's discussion of amethyst is divided into three parts, only one of which deals with the varieties of amethyst.[91] The first part is a long discussion of the origin of the name "amethyst," the second is a discussion of equal length of the varieties of amethyst, and the third is a short account of the medical virtues of the stone. Naturally enough, the title of the chapter mentions amethyst in general but not any of its varieties: "De l'amethiste et de l'aygue-marine." In sum, Berquen saw the varieties of amethyst as one topic in the natural history of amethyst, whereas Rosnel saw them as a way of organising the natural history of amethyst. In other words, Rosnel took the task of sub-dividing the category *amethyst* as seriously as he took the task of sub-dividing the category *precious stone*. The same applies to most of the other fifteen precious stones that Rosnel described. For some of those stones he even reinforced the distinction between varieties with a special typographical mark, such as a band of white space or the capitalised name of the variety. For Rosnel, classification *within* species was just as important as classification *between* species.

This is just what one would expect from a gem trader with an interest in the quality of materials and the summary exposition of a large corpus of texts. The chapters in Rosnel's lapidary have the same structure as the chapters in his guide to the prices of precious stones. The chapter on amethyst in *Estimation des pierres precieuses* contains a paragraph on each of the varieties of the stone; its title is a list of these varieties; and the varieties in question are essentially the same as the ones in the corresponding chapter in the lapidary.[92] The chapter on prices has nothing to say about the origin of the term "amethyst," the medical virtues of the stone, or famous historical specimens. What it describes, apart from the price of amethysts, is

the colour, hardness, and degree of polish of the different varieties of amethyst, as well as the relationship between these varieties and the varieties of other species. The emphasis that Rosnel placed on prices in his manual is easily explained by the fact that different varieties had different prices—four carats of Carthaginian amethyst was worth ten times less than the same amount of Oriental amethyst, and Bohemian amethysts were worth even less than the Carthaginian variety.

The relationship between price and variety was reflected in Rosnel's use of the word "*qualité*" in his lapidary. He sometimes used this term as a synonym for the relative value of different stones of the same kind, as when he noted that heliotrope "de la premiere qualité" has the same price as jasper.[93] But Rosnel also used the term in ways that were closely connected to the division of individual gems into kinds, that is into "*sortes*" and "*especes*." Most obviously, different kinds of gem had different qualities: Oriental ruby was one *sorte* of ruby, and it had the *qualité* of a true ruby, which is to say that it was very hard and had a superb polish. But qualities did not just differentiate kinds. Sometimes, qualities *were* kinds. After describing Oriental amethysts, Rosnel went on to say that "there is still another quality of Amethyst, that is to say the Carthaginian."[94] By this he did not mean that all Oriental amethysts had another valuable property; he meant that, in addition to Oriental amethysts, there was another kind of amethyst. When Rosnel used "*qualité*" in this way, it was sometimes interchangeable with "*especе*," as in the following description of garnets:

> Oriental garnets are of three different *qualitez*, of which the first are called Syrian garnets, because of their violet colour, mixed with purple, which is very pleasing to the eye…the second have the colour of hyacinth, and the third *sorte* have a very blackish colour…[95]

Conclusion

Rosnel and Berquen contributed to a broad trend in early modern natural history, the shift from the "emblematic" approach of Renaissance naturalists to the "systematic" approach of their Enlightenment successors.[96] Briefly, emblematic naturalists described individual species in great detail whereas systematic naturalists described the similarities and differences between species. The former gave rich descriptions of species that were centrally concerned with their moral, symbolic and medical properties; the latter gave sparser descriptions that focused on a few key criteria that permitted comparisons between species. The transition from the one to the other was gradual, incomplete, haphazard, and occurred at different rates in the natural history of plants, animals and minerals. But the transition was real and important, and it calls out for explanation. In a recent monograph, Daniel Margocsy offers a promising new explanation in terms of the circulation of valuable goods. He argues that the drive towards systematic botany came from naturalists and entrepreneurs who needed simple criteria for identifying plants that they wished to purchase from distant correspondents.[97]

The case of Berquen and Rosnel confirms and modifies this explanation. Both men contributed to the shift to systematic natural history, Berquen by establishing hardness as a general criterion for distinguishing one gem for another, Rosnel by treating the sub-division of species as an organising principle rather than as one topic among many. Both of these innovations were driven by the authors' concern for identifying gems, which was in turn driven by their concern for distinguishing valuable gems from less valuable ones. But Berquen and Rosnel were neither naturalists nor entrepreneurs. They were certainly not the kind of free-wheeling proto-capitalists who (on Margocsy's account) drove much innovation in natural history and chemistry in the Dutch Republic in the seventeenth century. Rather, Berquen and

Rosnel were senior members of heavily regulated craft guild that traced its origins back to the thirteenth century. But this did not compromise their writings on gems. On the contrary, the regulatory environment of the guild was an important part of the context for their innovations in natural history. The goldsmiths' right to cut and polish gems, and the withdrawal of that right after 1631, helps to explain why Berquen was more sensitive than Rosnel to the hardness of gems. Rosnel's emphasis on the quality of gems was continuous with the quality control procedures that he enforced as a foreman of the guild and as the author of the *Traité sommaire*. Rosnel's two treatises, one on gems and one on guild regulations, had a common purpose (asserting the special authority of goldsmiths) and a common form (abridging a large collection of texts, whether archival documents or past treatises on gems). Berquen, Rosnel and Le Roy were experts in the use of texts, not just in the use of gold and silver and gems; and the contributions of Berquen and Rosnel to the natural history of gems were an extension of guild regulations, not an escape from them.

[1] Karel Davids, "Introduction: Bridging Concepts", *Isis* 106, no. 4 (2 December 2015): 835–39.

[2] Stephan R. Epstein, "Craft Guilds, Apprenticeship, and Technological Change in Pre-Industrial Europe," in Stephan R. Epstein and Maarten Prak, eds., *Guilds, Innovation and the European Economy, 1400-1800* (Cambridge University Press, 2008), 52-80, on 52.

[3] Pierre le Roy, *Statuts et privilèges du corps des marchands Orfèvres-Joyailliers de la ville de Paris* (Paris, 1734), iii. Examples of particular regulations will be given in more detail below, especially in section 2.

[4] This paragraph is based on a study of three major recent contributions to the topic: Epstein and Prak, *Guilds, Innovation*; Sheilagh Ogilvie, *Institutions and European Trade: Merchant Guilds, 1000-1800* (Cambridge: Cambridge University Press, 2011); Karel Davids and Bert de Munck, eds., *Innovation and Creativity in Late Medieval and Early Modern European Cities* (Surrey, England: Ashgate, 2014).

[5] Ogilvie, *Institutions and European Trade*, 1.

[6] The revisionist trend is summarised and defended in Epstein and Prak, "Introduction: Guilds, Innovation, and the European Economy, 1400-1800," in Epstein and Prak, *Guilds, Innovation*, 1-24.

[7] Epstein, "Craft Guilds, Apprenticeship, and Technological Change in Pre-Industrial Europe," in Epstein and Prak, *Guilds, Innovation*, 52-80, esp. 60-2.

[8] Eg. Epstein, "Craft Guilds," 54, 58-9 (enforcement problems), 67-70, 78 (external constraints on guilds). Cf. Karel Davids and Bert de Munck, "Innovation and Creativity in Late Medieval and Early Modern European Cities: an Introduction," in Davids and de Munck, *Innovation and Creativity*, 1-34, on 21-2 (markets), 24-6 (city powers), 26 (migration), 29-30 (state power), 32 (markets and migration).

[9] See the passage cited above, note 7.

[10] For a sustained case for the efficacy of regulation, from someone sensitive to the problem of enforcement, see Ogilvie, *Institutions and European Trade*, 4 (problem of enforcement), 44 ('merchant guilds…enforced their monopolies sufficiently to exercise real economic effects'), 75-89 (case for efficacy). Cf. Davids and de Munck, "Innovation and Creativity," where the authors ask whether guild regulation 'mattered' for innovation (4), and conclude that it often did, albeit indirectly and in concert with other forces (31).

[11] This paragraph is based on a study of five major recent contributions to this topic: Pamela O. Long, *Openness, Secrecy, Authorship: Technical Arts and the Culture of Knowledge from Antiquity to the Renaissance* (Baltimore: Johns Hopkins University Press, 2001); Pamela Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (University of Chicago Press, 2004); Lissa Roberts, Simon Schaffer, and Peter Dear, eds., *The Mindful Hand: Inquiry and Invention from the Late Renaissance to Early Industrialisation* (Amsterdam: Koninkliijke Nederlandse Akademie van Wetenschappen, 2007); Ursula Klein and Emma Spary, eds., *Materials and Expertise in Early Modern Europe: Between Market and Laboratory* (Chicago, IL: University of Chicago Press, 2010); Pamela Long, *Artisan/Practitioners and the Rise of the New Science, 1400-1600* (Oregan State University Press, 2011).

[12] The historiography of this topic is favourably reviewed in Long, *Artisan/Practitioners*, chap. 1. For a moderately sceptical review of the same literature, see H. Floris Cohen, *The Scientific Revolution: A Historiographical Inquiry* (Chicago, IL: University of Chicago, 1994), chap. 5.2.

[13] To judge from the papers in Davids and Munck, *Innovation and Creativity*.

[14] Eg. the chapters by William Ashworth and Simon Schaffer in Roberts, Schaffer and Dear, *The Mindful Hand*. The state is also the main institutional setting for studies of "expertise" in early modern Europe, eg. the chapters in ibid., part 2, and the articles collected in Eric Ash,

ed. *Expertise and the Early Modern State*, *Osiris* 25:1 (2010), and Ursula Klein, ed. *Artisanal-scientific Experts in Eighteenth-century France and Germany*, *Annals of Science* 69:3 (2012).

[15] Long identifies patronage by kings, princes and oligarchs as the main driver of artisan-scholar interactions between 1400 and 1600: *Openness, Secrecy, Authorship*, 14, 15, 102-3, 175, 210, 243. Smith also stresses patronage, along with commercial centres such as Amsterdam: *Body of the Artisan*, 33.

[16] Long, *Openness, Secrecy, Authorship*, 88-93 (proprietary attitudes). Smith, *Body of the Artisan*, 178, 197, 180, 211 (fine arts).

[17] Edgar Zilsel, "The Origins of William Gilbert's Scientific Method", *Journal of the History of Ideas* 2, no. 1 (1941): 1–32, on 26. Cf. "Beginning early in the [fifteenth] century, a few exceptional practitioners [of the mechanical arts] were able to move away from the guild context altogether": Long, *Openness, Secrecy, Authorship*, 96.

[18] The following are snapshots of a large literature. Inscriptions on paintings: Smith, *Body of the Artisan*, chap. 1. Books of secrets: William Eamon, *Science and the Secrets of Nature: Books of Secrets in Medieval and Early Modern Culture* (Princeton NJ: Princeton University Press, 1994); Elaine Yuen Tien Leong and Alisha Michelle Rankin, *Secrets and Knowledge in Medicine and Science, 1500-1800* (Ashgate Publishing, Ltd., 2011). Recipes in crafts: Francesca Trivellato, "Was Technology Determinant? The Case of Venetian Glass Manufacture, Late 17th Century - Late 18th Century," Mimeo, University of Venice, 1996. Recipes in general: Michelle Dimeo and Sara Pennell, eds., *Reading and Writing Recipe Books, 1550-1800* (Manchester: Manchester University Press, 2013). Learned treatises and practical handbooks: Long, *Openness, Secrecy, Authorship*, chaps. 4, 6, 7. Encyclopedia articles, data tables, and various other genres: Joel Mokyr, *The Enlightened Economy: An Economic History of Britain, 1700-1850* (New Haven: Yale University Press, 2009); Celina

Fox, *The Arts of Industry in the Age of Enlightenment* (Yale University Press for The Paul Mellon Centre for Studies in British Art, 2009).

[19] James S. Amelang, *The Flight of Icarus: Artisan Autobiography in Early Modern Europe* (Stanford, Calif: Stanford University Press, 1998); Adam Smyth, *Autobiography in Early Modern England* (Cambridge, UK: Cambridge University Press, 2010), chap. 2.

[20] On the archival turn in general, and on its relationship to the history of science, see the following surveys of a mushrooming literature: Filippo de Vivo, Andrea Guidi, and Alessandro Silvestri, "Introduction, Archival Transformations in Early Modern European History", *European History Quarterly* 46, no. 3 (2016): 421–34, esp. 421 ("archival turn" term used), 424-5 (science); Alexandra Walsham, "The Social History of the Archive: Record-Keeping in Early Modern Europe", *Past & Present* 230 (November 2016): 9–48, esp. 32-5 (science); Elizabeth Yale, "The History of Archives: The State of the Discipline", *Book History* 18, no. 1 (30 October 2015): 332–59, esp. 351-3 (science).

[21] A study of the three literature reviews in the previous note, of six recent edited collections dealing with early modern archives, and of the online archives of Archival Science, has turned up a total of *two* articles that are centrally concerned with the archives of one or more guilds. The edited collections are those in *Archival Science* 7:4 (2007), *Archival Science* 10:3 (2010), *European History Quarterly* 43:3 (2016), *Storie della Storiographia* 68:2 (2015), *Isis* 107:1 (2016) and *Past & Present* 230:11 (2016). The two papers are Jennifer Bishop, "The Clerk's Tale: Civic Writing in Sixteenth-Century London", *Past & Present* 230:11 (November 2016): 112–30; "Secrecy and Authority in Late Sixteenth- and Seventeenth-Century London", *The Historical Journal* 40:4 (1997): 925–51. Note also Marco Schnyder, "'This Memorandum Is One of the Best Documents We Have': The Use of Archives and Documents by the Swiss Merchants in France (17th-18th Centuries)", unpublished manuscript.

[22] Le Roy, *Statuts et privilèges*, iii-iv. Here Le Roy gives a brief history of attempts to summarise the archive, and the first text he mentions is *Recueil des statuts, ordonnances, règlemens et privilèges, accordez en faveur des marchands orfèvres jouailliers de la ville & fauxbourgs de Paris* (Paris, 1688). Cf. René de Lespinasse, *Les métiers et corporations de la ville de Paris: XIVe-XVIIIe siècles, vol. 2: Orfèvrerie, sculpture, mercerie, ouvriers en métaux, bâtiment et ameublement* (Paris, 1892), 7, 7n4. Le Roy and Lespinasse seem to have been unaware of Rosnel's *Traité sommaire*.

[23] Rosnel, *Traité sommaire*, Dedication ("ceux qui"), and "Extraict sommaire", p. 1 ("fermer la bouche").

[24] Ibid, title-page ("preuves et justification"), and "Recueil", 25 ("Originaux", "transcrit", "conservez"), 33-45 ("Contre les Marchands Merciers", etc),

[25] Pierre Le Roy, *Inventaire général des archives de la Maison commune du Corps des Marchands Orfévres Joyailliers de la Ville de Paris*, 2 vols. Vol. 1 is at AN/T/1490/11; vol. 2 at AN/T/1490/12. Volume 1 is dated 1736. Here as in the rest of this paper, "AN" refers to the Archives Nationales in central Paris. Le Roy did not refer to the inventory or the relocation of the archive in his *Statuts et reglements* of 1734, suggesting that the relocation occurred after this date.

[26] Le Roy, *Inventaire*, "Avertissement", vol. 1, i-ii. "…de temps immémorial...qui nous sont pres pretieux...au prejudice des affaires du Corps, dans la poursuite desquelles ils doivent toujours nous guider...Gens qui n'ont pas toujours le même interest que nous a eviter la dissipation de nos Titres…"

[27] Le Roy, "Avertissement", ii-iii. "…le tout fut trouvé pêle mêle dans une extreme confusion, par la negligence que l'on avoit eu depuis longtems de remettre chaque chose a sa place. Ensorte que de ce nombre prodigieux de Pieces de toute espece recueillies, et successivement accumulées depuis pres de cinq cens ans, à peine en estoit-il resté quelques

unes rangées de suite sure un même sujet. La premiere chose qui se presenta donc à faire, ce fut de debrouiller ce Cahos…"

[28] Unfortunately Le Roy does not name this pioneering goldsmith-archivist.

[29] Ibid, vi. "Il falut donc incessamment dresser un autre Inventaire plus complet, moins fautif et mieux distribué…

[30] Many of the registers from this archive can be identified in the present-day archive of the guild, held at the National Archives in Paris. But few traces survive of the loose documents that made up the core of the archive described by Le Roy. The catalogue of the modern archive is Françoise Arquie and Michèle Bimbenet-Privat, "Archives de la communauté des orfèvres de Paris: Repertoire numérique detaillée de la sous-série T1490" (Paris: Centre historique des Archives Nationales, 1987-2001), available online at http://www.archivesnationales.culture.gouv.fr/chan/chan/fonds/EGF/SA/InvSAPDF/T-1490.pdf.

[31] Le Roy, "Avertissement", ix ("l'Histoire abregée du Corps").

[32] Title-page and vi (original documents), vi (scholarship), vi and viii (meanings of terms), xi ("ordre méthodique", "l'origine, les motifs & l'esprit"), 3 (1260 statutes).

[33] Ibid., vol. 2, 394. *Recueil des statuts, ordonnances, règlemens et privilèges, accordez en faveur des marchands orfèvres jouailliers de la ville & fauxbourgs de Paris* (Paris, 1688), 584.

[34] Sentence du prévôt de Paris, 18 Nov 1387, extracted in Le Roy, *Inventaire*, FFF.1. Cf. *Receuil*, 534, 612; Le Roy, *Statuts et privilèges*, 6. In the sixteenth century few Paris goldsmiths owned diamond-cutting mills: Bimbenet-Privat, *Orfèvres du XVIIe siècle*, vol. 2, 393.

[35] Lettres patentes, 4 Nov 1581, extracted in Le Roy, *Inventaire*, FFF.4. Cf. *Receuil*, 556.

[36] Sentence du Bailly du Palais, 27 Nov 1529, extracted in Le Roy, *Inventaire*, BBB.4. Cf. Le Roy, *Statuts et privilèges*, 200.

[37] Lettres patentes, Nov 1784, extracted in Le Roy, *Inventaire*, FFF.7. Cf. *Receuil*, 590, 592, 593.

[38] Le Roy, *Inventaire*, GGG.42–HHH.58. "Infringing" at *Receuil*, 632.

[39] Le Roy, *Inventaire*, FFF-HHH.

[40] The lapidary's guild was subsumed by the goldsmith's one in 1781, but few documents originating from the lapidaries survive in the goldsmith's archive. Notable exceptions are the minutes of the lapidary's meetings between 1776 and 1781, an account book from the same period, and a memorandum on the history of the gem trade in Paris (respectively, in AN T/1490, 29, 256, 4). The latter document paints a vivid picture of the trade in Paris in the years before the Revocation of the Edict of Nantes ("more than 300 diamond mills still in activity", "400 houses of very rich diamond merchants or diamantaires") but the document was written nearly a century after the event and contains at least one wild exaggeration ("at the time of the Revocation of the Edict of Nantes, only France or rather Paris dealt in the commerce of diamonds").

[41] Gedalia Yogev, *Diamonds and Coral: Anglo-Dutch Jews and Eighteenth-Century Trade* (Leicester: Leicester University Press, 1978); Francesca Trivellato, *The Familiarity of Strangers: The Sephardic Diaspora, Livorno, and Cross-Cultural Trade in the Early Modern Period* (Yale University Press, 2009); Kris E. Lane, *Colour of Paradise: The Emerald in the Age of Gunpowder Empires* (Yale University Press, 2010); Tijl Vanneste, *Global Trade and Commercial Networks: Eighteenth-Century Diamond Merchants* (London: Pickering and Chatto, 2011).

[42] A double mill (*moulin double*) was in fact a single mill driving two grindstones (*roüe tournante*): arrêt de la Cour de Parlement, 7 March 1625, extracted in Le Roy, *Inventaire*,

GGG.36. Cf. *Recueil des statuts*, 610. The 1584 statutes mention mills and grindstones but not double mills: *Receuil*, 586-587.

[43] Bimbenet-Privat, *Orfèvres du XVIIe*, vol. 1, 42.

[44] François Farges, "Les grands diamants de la couronne de François I à Louis XVI," *Versalia*, no. 16 (2014): 55-79, on 73–74. Cf. Tillander, *Diamond Cuts*, 133, 155. The names of the lapidaries who cut the first brilliants in Paris are elusive. We do not even know who cut the most famous French diamond from this period, the French Blue. On the cutting of the French Blue, see François Farges, Scott Sucher, Herber Herowitz, Jean-Marc Fourcault, "The French Blue and the Hope: New Data From the Discovery of a Historical Lead Cast," *Gems and Gemology* 45, no. 1 (2009): 4-19. For the names of some people who may (or may not) have cut diamonds for Louis XIV, see Bimbenet-Privat, *Orfèvres du XVIIe siècle,* vol. 2, 401, 413, 415.

[45] André Félibien, *Des principes de l'architecture, de la sculpture, de la peinture, et des autres arts qui en dependent* (Paris, 1676), 358-363 and plates 56-59, esp. 360.

[46] Bimbenet-Privat, *Orfèvres du XVIIe siècle*, vol. 2, 395.

[47] Ina Baghdiantz McCabe, *Orientalism in Early Modern France: Eurasian Trade, Exoticism and the Ancien Regime* (Oxford, 2008), 231–243, cf. 187, 255, 257-259.

[48] Bimbenet-Privat, *Orfèvres du XVIIe siècle*, vol. 2, 93-96 (Flemish and Portuguese jewellers); vol. 1, 106-107 and vol. 2, 396 (Mazarin's jewellers).

[49] Ibid., vol. 1, 22.

[50] Ibid., vol. 1, 21.

[51] Ibid., vol. 1, 191.

[52] Ibid., vol. 1, 96-97, 107; vol. 2, 403-404, 416-417

[53] Le Roy, *Inventaire*, boxes X (religious communities); U, EE and FF (royal goldsmiths); BBB to QQQ (other guilds).

[54] Le Roy, *Statuts et privilèges*, 218.

[55] "Précis sur le reglement concernant l'orfévrerie," Archives Nationales, T/1490/2. Internal evidence suggests that this (otherwise undated) document was written in the middle decades of the eighteenth century.

[56] Le Roy, *Statuts et privileges*, esp. titles 6, 7, 10, 11 and 12.

[57] Ibid., iii. Le Roy, *Inventaire*, DDD.108.

[58] Le Roy, *Statuts et privileges*, 132-135.

[59] Ibid, 135 (relaxation). Le Roy, *Inventaire*, FFF, GGG and HHH (lapidaries); DDD and EEE (shopkeepers).

[60] Berquen: Bimbenet-Privat, *Orfèvres du XVIIe*, vol. 1, 245-247. Rosnel: Privat, *Orfèvres du XVIIe*, vol. 1, 497b (father); Archives Nationales, MC/ET/II/173, 17 Mar 1644 (step-father, paternal uncle); Privat, *Orfèvres du XVIIe*, vol. 1, 497b (grandfather, assuming "ROSNEL, Jean de 1625" is the paternal uncle mentioned in MC/ET/II/173); Privat, *Orfèvres du XVIIe*, vol. 1, 498a-b (son).

[61] Berquen: Bimbenet-Privat, *Orfèvres du XVIIe*, vol. 1, 18 (training). Rosnel: Privat, "Orfèvres à Rome," 476 (training); Privat, *Orfèvres du XVIIe*, vol. 1, 497a, 497b, 498a (dates).

[62] Berquen: Bimbenet-Privat, *Orfèvres du XVIIe*, vol. 1, 31. Rosnel: *Traité sommaire*, 51 (*aide de garde*); Nocq, *Poinçon de Paris*, vol. 3, 422 (*garde* and *grand-garde*).

[63] On the duties of the different kinds of *garde*, see Privat, *Orfèvres du XVIIe*, vol. 1, 28-31.

[64] Berquen, *Merveilles des Indes*, dedication.

[65] Ibid., 14. Félibien, *Principes*, 359.

[66] Ibid., 56 (turquoise), 22 (topaz and sapphire), 35 (amethyst), 48 (chrysolite), 50 (iris).

[67] *De l'estimation des pierres precieuses et des perles, ensemble des autres pierres moins precieuses*, in Rosnel, *Mercure Indien*, vol. 2.

[68] The rest of this paragraph is drawn from Berquen, *Estimation*, 1-2 (price in general), 16-17 (pearls), and passim.

[69] Ibid., 19 (hyacinth), 19 and 20 (emerald), 22 (amethyst).

[70] Rosnel, *Traité sommaire*, "Receuil", 39-41.

[71] Rosnel, *Traité sommaire*, "Institution des Orfèvres", p. 1 (definition), "Receuil", 64.

[72] Rosnel, *Mercure Indien*, vol. 1, book 2, esp. pp. 36-7.

[73] On the importance of metal purity in the assessment of journeymen, see Privat, *Orfèvres du XVIIe*, vol. 1, 21.

[74] Rosnel, *Traité sommaire*, "Reception", 4-6. Robert de Berquen, *Le livre d'allois en or et en argent, ou brève instruction pour répondre par devant mes seigneurs de la Cour des monnoyes en l'interrogatoire qui sera faitte et sur les alloiemans qui seront donné aux prétendans maistres en l'art d'orfèvrerie de Paris* (Paris, 1671), cited in Lespinasse, "Orfévres", 7n4.

[75] Berquen, *Merveilles des Indes*, 109-112.

[76] *Dictionnaire universel français et latin* [known as the *Dictionnaire de Trévoux*] (1721), vol. 3, 1301-2. The English word "lapidary" had another sense in this period that this dictionary does not mention. A "lapidary" was a written work that listed precious stones and gave a brief description of each. We find this sense in, for example, the title of a 1652 treatise by Thomas Nicol: *Lapidary or, The History of Pretious Stone*s.

[77] The second and enlarged edition of *Merveilles des Indes* appeared in 1669, and that of *Mercure Indien* in 1672; there was also a 1668 reprint of *Mercure Indien*. The 1672 edition of *Mercure Indien* was bound with the first edition of *Traité sommaire*. John Sinkankas, *Gemology: an Annotated Bibliography* (Metuchen, NJ, 1993), vol. 1, 97-98 (Berquen), vol. 2, 878-879 (Rosnel).

[78] Charles Dufay, "Sur la lumière des diamants", *Mémoires de l'Académie Royale des Sciences* (for the year 1735), 347-342, on 349-50. The other two authors were Boethius de Boodt and Jan Laet.

[79] René Réaumur, "Sur les Mines de Turquoises du Royaume", *Mémoires de l'Académie Royale des Sciences* (1715): 174-202, on 175-176. René-Just Hauy, *Traité de minéralogie* (Paris, 1801), vol. 2, 490. Hauy lent authority to the citation by repeating Berquen's (false) claim that he was descended from the person who invented the art of faceting diamonds.

[80] Antoine-Joseph Dezallier d'Argenville, *Oryctologie* (Paris, 1755), 14, 34.

[81] Based on a study of the texts and biographies in Sinkankas, *Gemology*; Curtis P. Schuh, *Annotated Bio-Bibliography of Mineralogy and Crystallography, 1469-1919* (Tucson, Arizona, 2007).

[82] The other two references were in the phrases "Par Robert de Berquen Marchand Orphevre à Paris" and "Les Exemplaires se debitent chez l'Auteur, en la rue des Lavendieres en la Maison des Marchands Orphevres." In other words, the book was written by a member of the guild and could be bought from the guildhall.

[83] Rosnel, *Mercure Indien*, vol. 1, "Au lecteur."

[84] Berquen, *Merveilles des Indes*, 29, cf. 19, 36.

[85] Ibid., chap. 2 (ruby), chap. 3 (topaz, sapphire), chap. 8 (opal).

[86] Ibid., 18.

[87] Félibien, *Principes*, 359-361.

[88] Berquen, *Merveilles*, 40 and dedication.

[89] Rosnel, *Mercure Indien*, vol. 1, Au lecteur; vol. 2, 10.

[90] Ibid., 21-22.

[91] Berquen, *Merveilles des Indes*, 35-37.

[92] Rosnel, *Estimation*, 9.

[93] Rosnel, *Estimation*, 20. Cf. idem, *Mercure Indien*, 54.

[94] Rosnel, *Mercure Indien*, 13.

[95] Ibid., 31-2.

[96] An early and influential version of this thesis is Michel Foucault, *Les mots et les choses* (Paris, 1966), chap. 5. The thesis has stood the test of time among historians of natural history. "Emblematic natural history" at William B. Ashworth, "Natural History and the Emblematic World View," in *Reappraisals of the Scientific Revolution*, ed. David C. Lindberg and Robert S. Westman (Cambridge, 1990), 303–332. "Systematic botany" at John Lesch, "Systematics and the Quantifying Spirit," in *The Quantifying Spirit in the Eighteenth Century*, ed. Tore Frängsmyr, John L. Heilbron, and Robin E. Rider (Berkeley, 1990), 73–111. "Systematic natural history" at Phillip R. Sloan, "Natural History," in *The Cambridge History of Eighteenth-Century Philosophy*, ed. Knud Haakonssen (Cambridge, 2006), 903–940, on 909.

[97] Daniel Margocsy, *Commercial Visions: Science, Trade, and Visual Culture in the Dutch Golden Age* (Chicago, 2014), chap. 2.